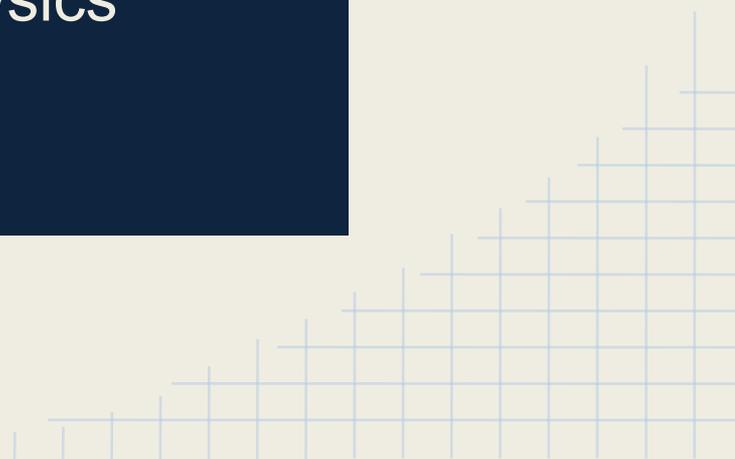




Week 11

Introduction to Data Analysis for Physics



New Textbook Sections

http://www.cs.utexas.edu/~evanott/PHY110C_Textbook/static/data_analysis/Analysis/gaussian.html#combining-distributions

http://www.cs.utexas.edu/~evanott/PHY110C_Textbook/static/data_analysis/Math/stats.html

Probability!

- Chance, random variables, sample space
- Notation
 - $P(X)$
 - $P(AB)=P(A\&B)=P(A \wedge B)$
 - $P(A \vee B)=P(A+B)$
 - $P(A|B)$
- Independence
 - True iff $P(A|B)=P(A)$
 - Alternately, that $P(AB)=P(A)P(B)$

Probability Distributions

- Assign probability to each possible outcome
- Expected value is average of outcomes' values weighted by probability of outcome:
 - $\langle f \rangle = f_1 * P(1) + f_2 * P(2) + \dots$
 - $\langle f \rangle$ need not be a possible single outcome
- Simple models: coins, dice

Sidebar: Combining Distributions

[Analysis/gaussian.html#combining-distributions](#)

We'll need to be able to combine distributions shortly.

Flip It, Flip It Good

- Take a penny, flip 6 times, record the sequence:
 - e.g., HTTHHH
- If coins are fair, what is the expected number of heads?
- What are the odds of getting your particular sequence?
- In groups of 3 people, what's the average number of heads? The standard deviation of your sample?
- Report group values AND first two flips to Evan

Coin Results

| Mean | Std. Dev |
|------|----------|
| 3 | .82 |
| 1.75 | 1.8 |
| 4.67 | .59 |
| 3 | 0.36 |
| 3.5 | 0.2 |
| | |
| | |

Coin Results

| First \ Second | H | T |
|----------------|---------|---------|
| H | 4->.267 | 2->.133 |
| T | 5->.333 | 4->.267 |

Significance

- Are our results strange? How strange can they be before we call the Mint?
- Use a Gaussian model to look at statistical significance.
- z-scores, p-values, confidence intervals: next week!

Reviewing our Data

- (Cheating and using topics of future past)
- In binary case, mean is Np , variance is $Np(1-p)$
- Apply to your sample. How many standard deviations are you away?
- For class sample, do we need to call the Mint?

Extra: OpenIntro

<http://www.openintro.org/stat/slides.php>